



The No.1 Aquaponics magazine
for the backyard enthusiast.

Issue 8

First Quarter 2010

Bringing Food Production Home

Backyard Aquaponics



Picking from the patch

Interview with **Dr. James Rakocy**

What is **Jambalaya**?

Welcome

In this edition we have some fresh new ideas for the magazine. Firstly we begin with a new regular contribution by Mark England, based on his journal and online blog called "Picking From The Patch". We'll be following his experiences in future editions of the magazine as he and his family demonstrate how they use their aquaponics system to provide food for their family, along with an educational experience for their two young daughters.

We also bring you the first in a set of interviews by Sylvia Bernstein, where she'll be talking with a number of key aquaponics representatives within the United States. In this issue we get a brief but intimate account of Dr James Rakoczy's life and his involvement in aquaponics over the past 30 years. This is a fantastic insight into one of the world's most influential people involved in aquaponics.

In the next edition Sylvia interviews Rick Mueller, who runs the aquaponic systems found at Growing Power. If you don't know who or what Growing Power is, then you're in for a treat with the next edition, as we delve into the "growing

revolution" at their site in Milwaukee.

On page ten you'll find an in depth article from Wilson Lennard about a recent NFT system he has designed and built in New Zealand, where they are trialling the growth of different herb crops in a greenhouse.

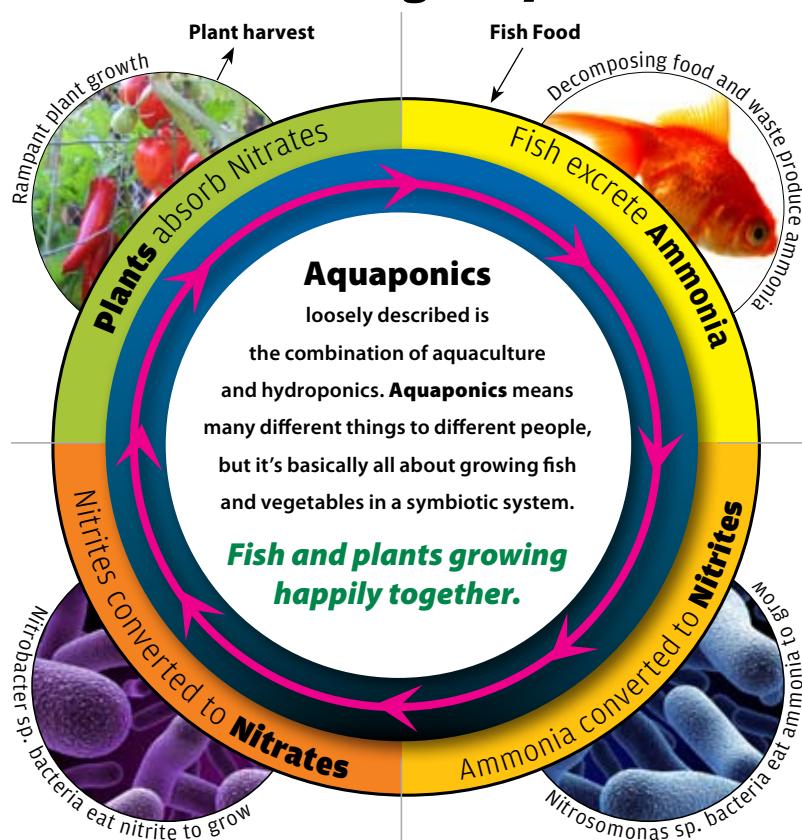


Also in this edition we've focused on bringing you details about backyard systems. Members of the Backyard Aquaponics Forum who have built their own aquaponics systems in their backyards, we follow their trials and tribulations along the way as they produce their own food.

As you can see, this issue is packed with information, and there are some great things to look forward to in the coming editions. We look forward to sharing more aquaponics with you in the future. ●

Joel Malcolm, Editor

The Nitrogen Cycle



Backyard Aquaponics on the tube

There is a whole range of aquaponics videos that you can view on youtube, visit the link below and see us in action! <http://www.youtube.com/user/backyardaquaponics>



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The Hopefhs

By **Murray West** and **Fiona Gibbs**

Our backyard is nestled at the edge of the Adelaide Hills, in South Australia. Our summer temperatures often exceed 43°C and we are currently in the middle of a drought and have recorded several consecutive years of the driest summers on record. South Australia, like most other states in Australia, has been under very tight water restrictions for a number of years.

We discovered Backyard Aquaponics after watching an episode of *Gardening Australia*, which featured Joel Malcolm and his aquaponics system. We then found the Backyard Aquaponics website and purchased a copy of the BYAP Manual. We were soon hooked on the idea of being able to grow our own organic produce in our very own backyard.

Aquaponics really has no size restraints and we were able to turn the small amount of space that we had in our backyard, into a highly productive aquaponic system. What more could you ask for, aquaponics provides

a system to grow vegetables with minimal water and boasts a bumper crop of fish at the end of the growing season. We are Murray West and Fiona Gibbs, also known as 'The Hopefhs'. Welcome to our backyard adventure.

For us the journey began in 2007, when Murray started designing, measuring and building, a plastic covered greenhouse. The frame is made of steel, and can be easily disassembled if required. After doing a lot of research, and collecting information from various sources, we decided to spend more than anticipated. We purchased good quality commercial plastic as well as a strong interlocking connector system to install the plastic film. After a few days of tedious labour the greenhouse was complete. We used an old car radiator fan to control the air flow and temperature inside the greenhouse.



Murray and Fiona with their backyard greenhouse

Several weeks later we designed the grow beds. Originally we had intended to use recycled materials. This would save us money, but after an in-depth discussion with a few friends, we decided to make the grow beds from fiberglass. We used a sleeper cabin from a Kenworth T600 truck for the fiberglass mould. After several weeks of hard work fiber-glassing and we had three completed casings for our growbeds. The casings were then



The finished greenhouse



3000 Litre fish tank



Three large growbeds



els

“We were soon hooked on the idea of being able to grow **our own organic produce** in our very own backyard”



Our Favourite Tanks



Trout fingerlings



Crops include Chinese greens, beans, tomatoes and lettuce



Sump tank with pump and float switch

mounted into timber frames with adjustable steel legs. The final internal measurement for each of the grow beds was 2.3 metres by 0.9 metres.

Next we needed to decide on a growing media to fill our grow beds. Like many others delving into the world of aquaponics, we considered using gravel. Compared to other materials it is one of the cheapest options. However, we had not taken into consideration the weight of the gravel when designing and constructing our fiberglass grow beds. This restriction on weight limited us to a choice of two mediums, expanded clay or diatomite.

After much deliberation we chose diatomite to use as our growing medium. At this stage no one else we knew of had tried using it, and it appeared to have many positive benefits as a growing media. Diatomite is a hydroponic medium which has a pH level of between 5.7 and 5.8, often considered optimum plant growth. Most fish species require a pH of somewhere between 6.8 and 8.0. Fortunately for us we have been able to stabilize the pH at 6.8, most of the time. We found that we had healthy growth from both the plants and the fish, and neither of them showed signs of pests or diseases.

We had decided from the onset that we would purchase a Backyard Aquaponics' fish tank and a 3000 litre tank seemed ideal for the system we were planning. Initially we had grand ideas of farming Murray Cod, catfish, yabbies and marron. However, after further investigation into our climate and the requirements of each of these species, we decided to start with rainbow trout.

We have a trout farm not far from our home, where we are able to purchase our annual supply of fingerlings. In our South Australian climate we are very lucky, in that we are capable of growing trout, ten months of the year. Unfortunately we found out that our local trout do not like a water temperature over about 24°C. We learnt a hard lesson

“Our system has been in operation for two years and we have had both successes and failures in that time”

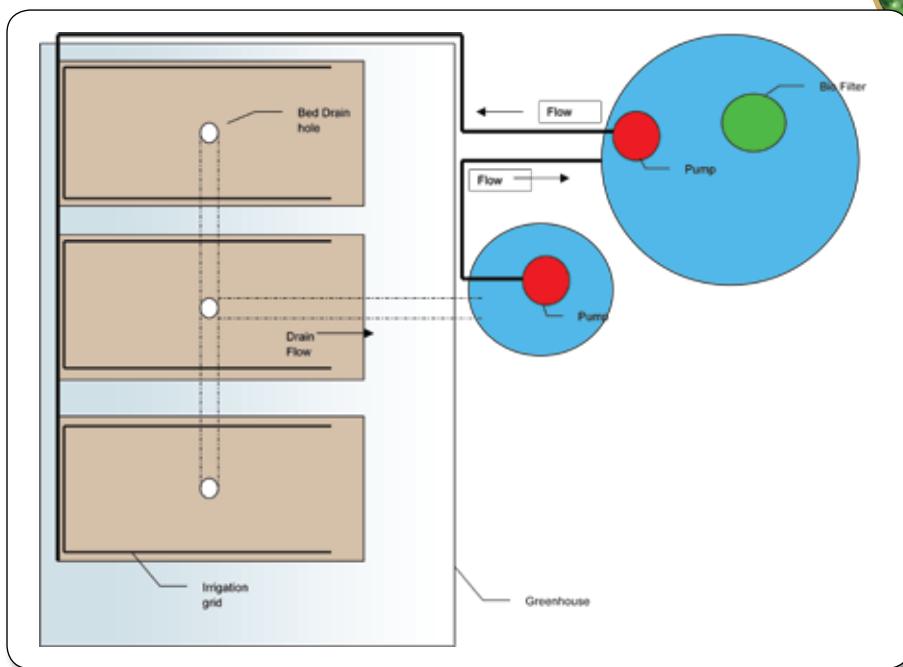
early when we lost twenty-five fish to the first heat wave that year.

Our system has been in operation for two years and we have had both successes and failures in that time. We are continually learning about the fascinating world of aquaponics and continue to develop our dreams and ideas into the reality of being able to produce our own fresh fish and vegetables.

Our major concern has been the continued fungal attacks to our plants. We believe some of this is due to the lack of proper ventilation within the greenhouse. We also believe that the diatomite has had some negative effect. The diatomite tends to absorb and hold a lot of water, it tends to draw water up to the surface of the growbed through capillary action. When this is coupled with temperatures above 50°C inside the greenhouse, fungal outbreaks have been common. To test how much of an effect the diatomite has had on the plants, we will be carrying out a trial.

The plan is to:

- Remove the top 10 cm of diatomite and replace it with expanded clay in one grow bed
- Remove all of the diatomite and replace



it with expanded clay in another growbed

- Keep one grow bed the same. This will be the control to gauge any changes or differences between the beds.

From the results of this trial, we hope to find a solution to reducing the fungal attacks on our plants inside the greenhouse. We will also be improving the ventilation system, by upgrading the existing fan to something that has a greater capacity to move air.

Overall we have had a great deal of success with the system in its current form, even

though we have had these minor issues to contend with. The vegetables we have produced have been full of flavour and crispy fresh. We have produced enough to feed a family of three, with abundance. We have grown a wide variety of vegetables, and have had great success with the majority of them.

As we venture forward we'll be looking at further ways of improving our system. Our next big project will be to upgrade the electrical system and connect it to the main grid. We are very happy with our system and hope that our story has inspired you to build your own aquaponics system. ●



Trout harvest



Rear bed is topped with expanded clay



By the Barbeque

Jambalaya

What is Jambalaya?

By Faye Arcaro

Ingredients

500g cooked shredded chicken
250g spicy pepperoni sausage
500g yabbies or prawns
500g tomatoes
500g small red onions
2 capsicums or red peppers
2 stalks celery
10 okra
2 cups chicken stock
 $\frac{1}{3}$ cup tomato paste
1 Tbsp oregano
1 Tbsp parsley
1 Tbsp basil
1 Tbsp garlic chives
3 cloves of garlic
2 cups uncooked rice
1 tsp cayenne pepper
1 tsp paprika

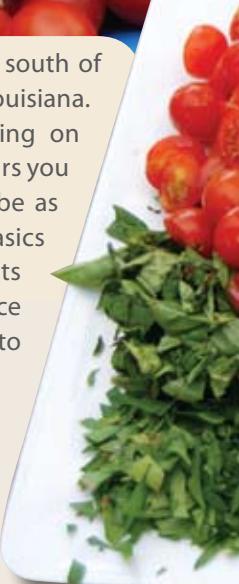
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ambalaya originated from the deep south of the United States around the state of Louisiana. It's a Creole or Cajun dish depending on which area you're from, or which flavours you prefer. The recipes for Jambalaya can be as varied as you could possibly imagine but the basics always remain the same. It's a mixture of meats and vegetables cooked in the one pot with rice and stock added during the cooking process to add bulk to the dish.

Jambalaya is closely related to its Spanish cousin the Paella, and not far removed from an Italian Risotto as well. It seems many cultures have their own take on a one pot meal of assorted meats, vegetables and rice. There are many differences between the three dishes with probably the main difference being the spiciness of the Jambalaya, many Jambalayas can have quite a kick to them, whereas Paella and Risotto are more mild.

Gumbo is also fairly similar and originates from the same areas of the southern United States. The main difference in a Gumbo compared to Jambalaya is the rice, rice is cooked separately to the main stew or soup when preparing a Gumbo, and then the soup or stew is poured over the rice on a plate or in a bowl.

You can really experiment with Jambalaya, if you don't have a particular ingredient you can always substitute something else to your liking. And the best part of this dish? You only have one pot to clean up when you're finished.





Method

- Cut sausage into small cubes, chop onions, capsicum, celery and tomatoes.
- Slice okra and place into slow cooker with vegetables, sausage and chicken.
- Mix tomato paste with chicken stock and pour over all ingredients, sprinkle with seasoning and paprika.
- Add all chopped oregano, parsley, basil, garlic chives and garlic and stir.
- Place lid on and cook for 4 hours.
- Add 2 cups uncooked rice and chopped prawns.
- Stir through and continue cooking until rice has absorbed moisture.
- Garnish with parsley and serve with crusty fresh bread. ●





Our Favourite Tanks



Healthy crop of Dill



Greenhouse after construction

Commercial NFT Aquaponics

By Wilson Lennard



In the classic aquaponics system, with media filled beds, the gravel bed is used for many purposes. It acts primarily as a place for the plants to grow, but it also acts as a solids filter. Filtering out large and small particles and depositing them in the grow bed. The gravel bed is also a solids mineralisation device. The solids that are trapped in the bed are then broken down or mineralised by bacteria and other organisms. And finally the gravel bed acts as a bio-filter, where the bacteria colonise and convert valuable nutrients to a form that is available to the plants.

Growing plants in aquaponics is based loosely on the methods and techniques used to grow plants in hydroponic systems. There are many different approaches to growing plants hydroponically. Nowadays, gravel or media culture is not often used in commercial hydroponic operations, because there are several drawbacks to this style, especially when systems are on a commercial scale.

Deep Water Culture (DWC) or Raft Culture (RC) is another hydroponic method which is often associated with aquaponics. Dr James Rakoczy's DWC system in the University of Virgin Islands, set new standards in aquaponics and has successfully used the raft culture method for many years now. This method usually accounts for all the system bio-filtration, as the deep flow tanks afford surface area for bacterial colonisation. Raft culture offers many other advantages which make it the most suitable for commercial use.

Another very popular hydroponic technique is the Nutrient Film Technique (NFT). NFT consists of a number of long channels, in which a very thin film of water flows. This film of water gives the plants access to the nutrients. Another very important aspect of the thin film of water is that it does not inhibit oxygen uptake by the plants roots. This has been shown to increase nutrient uptake, as well as increasing the health and vigour of the plants.

NFT is still not often used in commercial aquaponics. There seems to be a preference for DWC systems and this is for several perceived reasons and arguments, including:

- DWC has more water volume in the system, which makes it easier to operate and allows for "more room for mistakes", whilst NFT has far lower water volumes.
- NFT requires additional or more refined filtering components. Usually increased solids filtration and the addition of a separate biofilter, which increases expense.
- NFT uses small diameter feed lines (4 – 5 mm diameter black poly tubes as used for drip irrigation systems) and these block too easily and increase maintenance.

Another thing that can affect the use of NFT is the cost of using it. In my experience, it is usually far cheaper to build deep flow tanks on the ground, than to use bench supported NFT channels.



Sump tank and pump



Fish tanks in operation



Day 12 of NFT test



Our Favourite Tanks

The issue of irrigation pipes blocking in an NFT system is very interesting. Don't get me wrong, irrigation tubing does block. But, if you talk to any hydroponic NFT farmer they'll admit that irrigation tubing blocks in hydroponics as well. This is why two irrigation lines are fed to each channel. I am not yet convinced they block more often in aquaponics, especially if correct water filtration is employed.

It is true that NFT aquaponics does require the addition of a biofilter as there isn't usually enough surface area in the NFT channels to provide enough area for the bacteria to colonise. To me this is no problem as I always incorporate a separate biofilter into my aquaponic designs, even deep flow or raft culture systems. If a separate biofilter is used it means both components (fish and plants), may be uncoupled from each other whenever required and can operate independently of each other if required. I believe this is important in a commercial situation because it allows fish or plant production to continue when and if there are any problems with the other component. The design I often use for biofilters is a simple trickle filter which is fairly inexpensive. Therefore, the increased cost argument

is usually redundant and is adequately counterbalanced by the increased flexibility and lowered risk.

I also think raft culture is used far more widely in aquaponics because people are not currently using balanced aquaponic systems. A balanced aquaponic system is one where the amount of nutrient being produced by the fish in the system is equal to the amount of nutrient being taken up by the plants. This is an aspect of aquaponics that has not been well researched. In a small backyard or hobby system situation, it doesn't matter that much. However, when it comes to commercial aquaponic systems, I believe it matters a great deal! If the nutrient gets too high in the system (too many fish) it can have detrimental effects on the fish and plants. If the nutrient gets too low (not enough fish) then the plants won't grow to their full potential or take a lot longer to grow. Commercial production relies heavily on the profit margins made by the plant produce, so getting these things correct can be the difference between financial success and failure!

Because of the very large volume of water in deep flow culture, it takes a lot longer for

systems to become imbalanced. However, it does eventually happen. Generally, most commercial aquaponic system designs currently available tend towards using too many fish, so poor plant production is almost never seen. This does mean however, that the long term viability of the system in terms of elevated nutrient levels comes into question. The remedy that is often used is to remove a certain proportion of the nutrients from the system via a regular water exchange. This means that nutrients leave the system and are not utilised and may also impact on the environment. As Joel argued very well in his recent article on his commercial system (Malcolm 2009; Backyard Aquaponics, Issue 6, Page 10), the approach adopted over the last few years in aquaponics is to utilise as much of the nutrients as possible by mineralising solid fish wastes so they become dissolved and are returned to the system. The water exchange approach required for out of balance systems does mean that all the nutrients are not being utilised and are actually being wasted because they leave the system.

In NFT systems, there is a far lower water volume and the systems can become



unbalanced quickly. This is the major reason why many people who incorporate NFT as a plant growing component in aquaponics systems only do it on a proportional basis, and hardly ever use a total NFT system. In these cases a proportion of the system is always left as deep flow, so extra water volume is available to counteract fast nutrient build up and therefore, make the system easier to manage.

I have taken a different approach to aquaponics for some time now. My primary goal has always been to develop balanced systems so that no nutrients or water are wasted. Symbioponics™ is the name for a balanced design approach, which leads to a system with no nutrient accumulation. This means that I use a design model that allows me to balance fish nutrient output with plant nutrient uptake, thus enabling all the nutrients in the system to be utilised. When this is used in conjunction with an integrated management approach, it allows the system to stay in constant balance. The model is based on customised fish to plant ratios based on what specific fish species and plants are grown. Therefore, I am an advocate of customised commercial aquaponic system design, because generic systems will not meet the requirements of all the different fish and plant varieties that may be commercially cultured. For example, a system designed for Murray Cod and herb production is far different from one designed for Jade Perch and lettuces; therefore a customised design is required.

It turns out that NFT is the best system in which to test my theories and models on because, as I explained above, NFT systems have the ability to go out of balance far quicker and easier than deep flow systems. I have spent the last six months designing, building and operating a 100% NFT aquaponic system in New Zealand. This project has been initiated and financed by Ashley Berrysmith and the Berrysmith Foundation, a foundation started to educate the world about sustainable farming practices. Ashley is an Auckland based

businessman who has a large fresh-cut processing operation, New Zealand Fresh Cuts. The trial is being undertaken at the business of Yoka DeHoweur and Don Grant, owners of Tasman Bay Herbs, a fresh herb producer in New Zealand's South Island.

We have built a greenhouse to house a NFT aquaponics system and a standard NFT hydroponics system next to each other so we can directly compare the growth rate and production in the two systems. The aquaponic system consists of a recirculating fish component built in a separated part of the greenhouse which is insulated. The fish system utilises a swirl sedimentation tank for gross solids removal, a static micro screen filter for fine solids removal and a trickling biofilter for biofiltration. I have been mineralising all solid fish wastes for return to the aquaponic system for several years now, so the system also incorporates a mineralisation tank. The plant growing component in the aquaponic system consists of four NFT benches with six metre long NFT channels, built in the eastern half of the greenhouse. The western half of the greenhouse is used for the standard hydroponic NFT system, which uses standard nutrient tanks and dosing pumps and is a direct copy of the aquaponic NFT array.

Both systems have been up and running for several months now. The hydroponic system is consistently producing hydroponic herbs which are being integrated into the existing business's sales. I have only recently started to culture plants in the aquaponic system, even though I have had Grass Carp in the system since early October, 2009. I chose Grass Carp because they are herbivorous and another experiment that will be trialled soon is to produce fish fed on the green waste produced from the system. I've had the Grass Carp in the system for all this time without plants because I like to build-up nutrients in the system and get the levels up to my balance point before adding plants. When the plants do eventually go in, I know that the nutrients are at the optimum level for healthy, sustained growth.

I have grown two test crops, Salad blend and Dill, in the aquaponic system, with excellent results. And I have harvested 150 bunches of Salad mix and 300 bunches of Dill, so far. The Salad blend grew from seed to harvest size in five weeks, as did the Dill. We are now at the stage where we will begin twelve months of intensive herb and lettuce trials.

The design approach is working very well and the system is very easy to manage and keep in balance. In addition, my design approach has been developed so I can retrofit any standard hydroponic system or any standard recirculating aquaculture system, at a later date. To this end, the project has been a very successful trial of this because essentially, the NFT component of the aquaponic system was an analogue of the standard NFT hydroponic system sitting next to it. Retrofit is an integral aspect to my design approach because there are currently many established standard hydroponic farmers who are interested in a hydroponic approach fed by an organic nutrient source, which is what aquaponics offers. However, these farmers will want to be able to use their existing hydroponic equipment, as a total re-build would be economically unviable.

All we have ahead of us now is twelve months of data collection and happy aquaponics system operation! We are all very happy with the results of the trial so far, and look forward to researching and developing our ideas in the future. If you would like to learn more about our projects please visit our website. ●

About the Author:

Wilson Lennard, PhD has been studying aquaponics for many years. He is a PhD graduate of RMIT University in Australia. He has designed and constructed commercial based aquaponic systems both in Australia and overseas. Wilson has also contributed to aquaponic lectures globally over the last four years. wil.lennard@gmail.com www.aquaponic.com.au/



Announcement

Congratulations

to the 2009 Backyard Aquaponics Forum photo competition winner!



Shane (aLostHippy) from the BYAP forum has won the 2009 photo competition. The picture of his boys pet frog chewing on a tooth brush, proved to be a big hit.



Some early contributions for the 2010 competition



The 2010 photo competition is now well underway
Please see the Backyard Aquaponics forum site for further details.



My aquaponics *obsession!*

By **Nam-Ha Quach**

My aquaponics journey started in January, 2009, when I read an article in a gardening magazine about the concept. My wife Hayley and I are keen gardeners and were both looking at ways to maximise the amount of produce we could grow at home, therefore minimising our requirement to purchase food from the grocery store.

T

he reading and research that we performed on the ridiculous amounts of chemicals that conventional produce is exposed to and the damage this was likely to be causing us, was alarming to say the least. Not wanting to poison our children like we had ourselves for the past thirty years, we committed to organic gardening. Aquaponics to me was a simple and necessary progression from our traditional dirt garden. The reputed water savings and being able to provide fish for the family were added bonuses to the masses of fruit and vegies' aquaponics can and does produce.

To find out more about aquaponics, I did a quick search on the web and came across a number of forums, which I promptly joined to do my research. After spending hours upon hours of reading and designing, I decided to take the plunge and make my very first system as a "concept" system. I needed to prove to myself that the theory

actually worked in practice. After much deliberation, I finally went with two 500 litre tanks linked together; with grow beds made from halved olive barrels. I picked up some silver perch and trout, gravel, some seedlings and I was off! To say the "concept" system was a success is a bit of an understatement. The vegies far surpassed the dirt garden in terms of health, volume and water use. I was convinced that this was the way to go.

Late in September, 2009, I decided that it was time to design and build a bigger system. The design took many incarnations but eventually I went with a Constant Height In Fish Tank Pump In Sump Tank (CHIFT PIST) design, using three Intermediate Bulk Containers (IBC) as fish tanks and one as a sump tank. For grow beds, I used six 500 litre stock feed troughs filled with

some gravel, which was donated by a friend. This gave me my desired ratio of one to one; that is for every litre of fish tank water there was a litre of grow bed medium as my bio-filter. I had 3000 litres of fish tank water and 3000 litres of grow bed medium. I used the widely accepted safe stocking rate of three kilograms of fish per 100 litres of bio-filter and figured that I could stock my system with a maximum of 180 fish at 500 grams. Plenty of fish for myself and the family once they had reached plate-size!

“**being able to provide fish for the family** were added bonuses to the masses of fruit and vegies' aquaponics can and does produce”

To avoid harvesting all my fish at once, I decided to go with a variety of species for my system. I purchased thirty-five Murray Cod fingerlings for one tank, seventy-five Silver Perch fingerlings, fifty Australian Bass and twenty-five Catfish for another tank and have left the third tank empty to stock with Rainbow and Brown Trout for when the weather cools down. My theory was that the cod, bass and catfish would take up to three years to grow to plate-size, the silver perch about two years and trout in one year. This would provide me with a number of different fish to harvest and restock after two to three years, with trout being the constant harvest each year. So far the fingerlings have grown very well in the warm weather and hopefully they will be fat enough to make it through the coming winter. What I have found so far, is that the



Star pickets help to support the sides of the growbed



A full aquaponic dinner is served



Our Favourite Tanks

cod is growing considerably faster than expected, so perhaps they will grow out in only two years, but the bass is growing very slowly, so definitely a three year plus grow out fish.

The vegies that these wonderful fish feed with their waste are growing amazingly well and combined with the organic veggie patch and fruit trees; they have kept the family well fed without having to purchase any fruit or vegies, except bananas, since mid November. Our two boys love their strawberries and they have both been able to pick half a dozen to share every two to three days since late November.

I had read in a gardening magazine and on the web that banana peels provide potassium as they decompose, so I have buried banana peels throughout the grow beds to boost the potassium levels for flower and fruit production. The bananas we purchase are pesticide free and thus do not



The boys checking depth



A child proof sump tank

endanger the fish or compromise the organic principles. I'm no scientist but, it seems to be helping the strawberries produce flowers and fruit along with the tomatoes, egg plants, capsicums, cucumbers, beans, pumpkins, watermelons and chillies, so I'll keep burying the peels until the family tires of eating bananas. Along with all of these fruits and vegies, we are also enjoying tons of lettuce, basil, spring onions, rainbow chard, garlic chives, carrots, oregano, thyme, sage, peas and corn. We have also experimented with grapes, thornless blackberries, kiwi fruit, raspberries and currents. Although they are yet to flower and fruit and most likely won't for at least another season, their foliage growth has been phenomenal!

Despite the successes, the system has had its share of set backs. Pipe work leaks, grow beds bowing at the sides, sunburnt plants and four catfish deaths. The plumbing leaks were painful but easily fixed with a bit of digging, the bowing sides were staked with star pickets, sunburnt plants were shaded and to stop more catfish swimming up



The aquaponics obsession takes shape



Shade cloth provides shelter from the hot sun

the outlets of the fish tanks, mesh screens (gutter guard) was used at the outlets.

And so my obsession...I mean journey continues, with plans for a dedicated trout system, expansion of my current system to include more grow beds, NFT channels, yabby tanks...the list keeps growing and growing. ●

More information about my system as well as a wealth of other information can be found by going to the Backyard Aquaponics Forum and searching for "Quachy".

www.backyardaquaponics.com/forum

Hooked on aquaponics

By **Mark & Janette England**

Black Saturday here in Victoria was hot and dry. The wind was incredible and I remember saying to my wife that there was no way that Dean from Grow Fresh Aquaponics would be mad enough to deliver our new BYAP system on a day like that.

I expected a call from Dean saying, "lets do it another day." How wrong I was. Not only did he deliver the first incarnation of our BYAP system but he also installed it. Peter Dickson, the man responsible for getting me hooked on AP was also in attendance and even took a dip in the tank with a beer to cool down after it was installed.

So to introduce how we became interested in aquaponics I need to go back a little. From the first time I set eyes on Dicko's system I was hooked. I couldn't believe that a fish tank could grow veggies. It seemed too simple and so I decided to get straight on to building a small test system. This system was up and running on 2nd November 2008 and at the time all I thought I'd



First test system



Second BYAP system



First BYAP system

Our Favourite Tanks



Mark and Janette England with kids

ever want. How wrong I was AGAIN.

Fast-forward back to Black Saturday and our BYAP system. We planted many things and were thrilled to finally have a veggie garden. We moved the 12 gold fish from the small original system and put them in their new big home. 4 weeks later we added 25 trout and could not believe how quickly things grew. We had planted cauliflowers, broccoli, corn, beetroot, herbs etc. Our Daughter Grace loved going out every day feeding the fish and looking for something to pick, but after a few months I decided that I really wanted to be able to feed ourselves as much as possible. I was over the supermarket rubbish that we were paying top dollar for.

So a request for funding was placed with the Minister for Finance and we pulled down one of 2 garden sheds we had in another part of the backyard and installed a second incarnation of the system on the 24th October 2009.

It meant a fair amount of logistics in moving the system to its new location. We pumped water from the fish tank to the new grow bed then transferred the trout to the grow bed full of water. We moved the fish tank to its new home and then pumped the water from the grow bed into the tank whilst moving the trout.

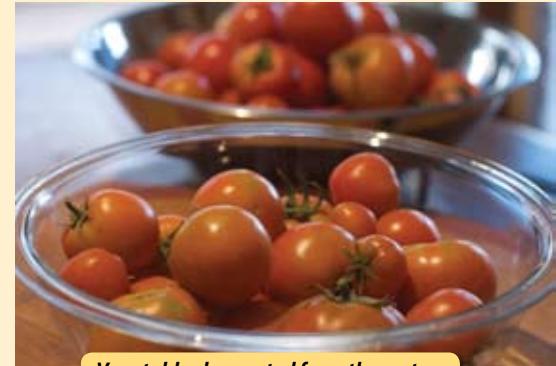
The trout actually did much better than we expected in the move, but we had

already invited a few friends around for a trout dinner. It was getting on towards the warmer months and we wanted to start with a new fish variety.

Once the tank and fish were relocated we moved onto transplanting the grow beds. The easiest way was to put the new one in place and move both plants and clay balls from the old grow bed to the new one. We were surprised to find hundreds of worms in amongst the clay balls whilst moving them. We'd only placed around ten worms in the bed a few months earlier. They obviously love the environment of the grow bed. We continued on and after a few hours had the new system installed and running. That night we harvested all 12 trout from the system and cooked them up very simply in the wood fired oven.

We were concerned about how our 2 yr old daughter would react with the fish harvest but decided it was a part of being a "farmer" and "consumer". I feel we are too often disconnected from our food that we don't realise what needs to happen so that we can have perfectly packaged meat in our pristine supermarkets. We told her what we were going to do and she watched me cut the fish to kill them. It's one of life's lessons I'm glad I was able to teach her and that she took it on board with no problems.

A week or so later we needed to get fish back into the tank. A quick search had us



Vegetables harvested from the system

heading out to Glenwaters fish farm for some Murray Cod. I hadn't heard much about people using Murray Cod but there wasn't much else at the time so we went ahead with them. They have gone really well over summer and I am starting to think they will be a great long growing

fish to help keep the system ticking along. We'll add trout in the winter and maybe try something else over next summer while keeping the Murray Cod in the loop to keep things going.

We planted out the new second grow bed and then started to notice something that was much different to the original one bed system. Plants started growing very quickly. It was as if the whole thing had a new lease of life. The only thing we could put it down to was the extra hours of sunlight the system was now getting.

In the old location the wall of the house was blocking the sun after around 1pm.

We now had tomato plants reaching skyward at a great rate of knots, strawberries were producing flowers for the first time, pumpkins were spreading out their arms and trying to hold on to both sides of the grow beds and the jungle that was our lettuces, was incredible.

We got to the point that we were making bags of herbed salad mix and distributing them to the neighbours, as we couldn't keep up with the growth even though we were eating salads daily.

All this was doing was confirming to me that we really could aim for producing a huge part of what we consume. It was a much easier argument this time to take to the Minister



Healthy trout

for Finance and we were again on our way to pick up the new extension to the system.

We were now getting serious. Two new grow beds and a 3000lt tank. A lot of work went into preparing the site including pulling down the last garden shed and installing an electrical box to run the power for the pumps.

A truck was hired to pick up the new equipment and Dicko and his wife Sue again helped us out by moving the tanks and setting up grow bed stands.

A week later Dean and his wife Jen, from Grow Fresh Aquaponics were on site and a full day was spent installing all the new pipe work to get the system up and running. It was all coming into fruition and we started cycling the new system.



Grow fresh

A graphic featuring a fish swimming among several red cherry tomatoes, symbolizing the integration of aquaculture and hydroponics.

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Contact: Dean
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dean@growfresh-aquaponics.com



Our Favourite Tanks



Abundant growth

We did however notice just how hot the exposed clay balls were making the water now because they had no major shade from plants so we decided to install a shade curtain. It's designed so we can close the

months. Now it's time to enjoy our hard work.

Now that we have four grow beds our plan is to rotate them with seasonal

curtains in hot weather and in windy or inclement weather we can open them up.

We finished installing the shade curtain and therefore the final version of our aquaponic system exactly one year after installing the first BYAP system. It was the Black Saturday 1st anniversary. 12

plantings. We hope to achieve one grow bed being sown with seed, while the next is at seedling stage, the third would be almost ready to harvest and the fourth in full harvest. That way we can achieve a steady constant supply.

We have been preserving a lot of this season's produce and making things like green tomato pickles, pickled cucumbers, tomato sauce etc. This will ensure we are able to enjoy some of our produce all year round.

We have nicknamed the aquaponics system "the patch" and I've even started a blog at www.harvest365.blogspot.com to document what we harvest from the garden. Also we will be contributing a regular article in every edition of the Backyard Aquaponics Magazine, so keep an eye out for what we are up to in "Picking from the patch". ●

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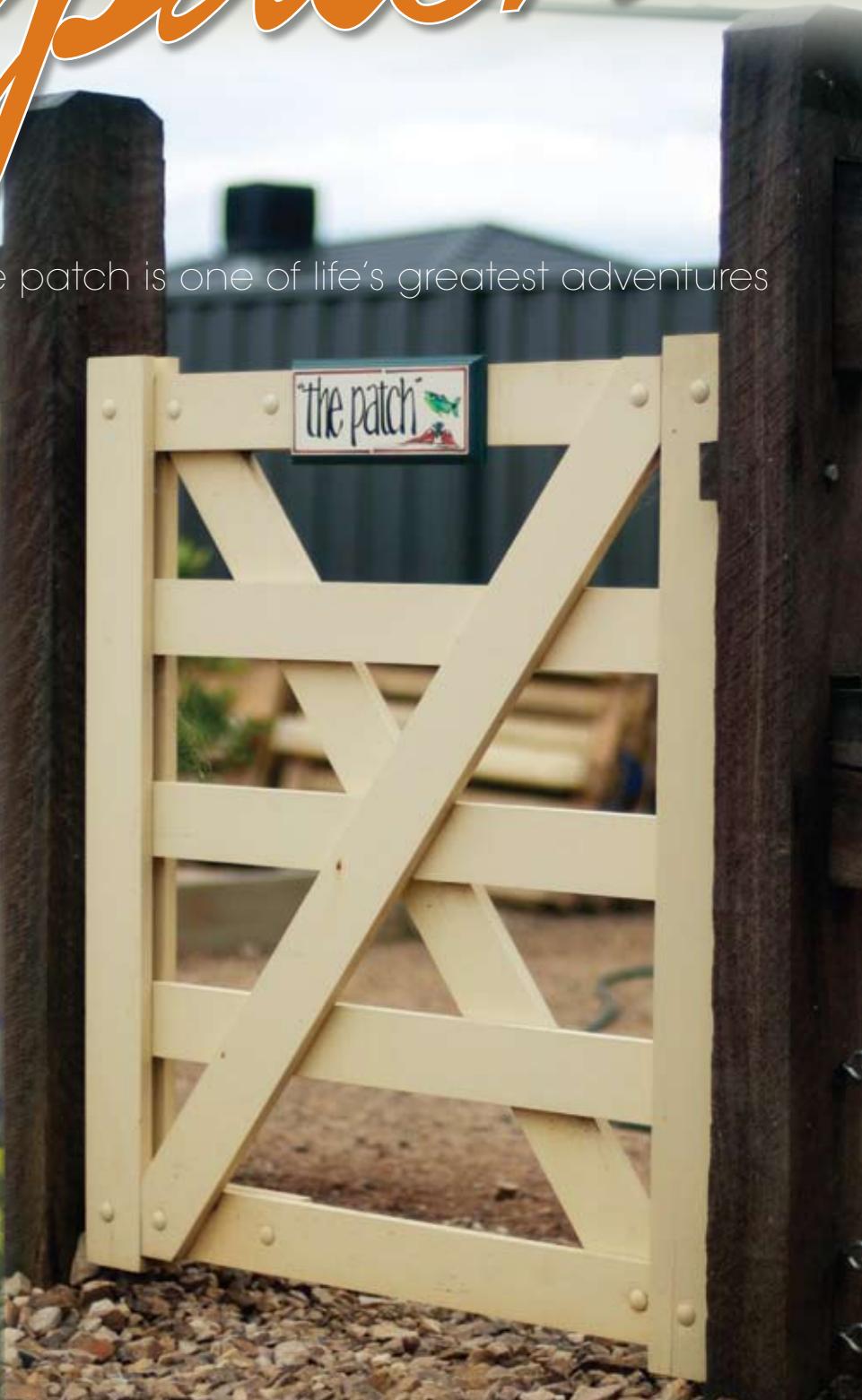
Picking from the patch

By **Mark England**

Growing up with a veggie patch is one of life's greatest adventures

Watching something grow from seed, flower, fruit and finally ripen on the plant is truly rewarding. Picking a season's first harvest and eating it just seconds after, tasting real flavours and smelling amazing aromas is something too many children these days miss out on.

A supermarket shelf full of picture perfect fruit with no flavour is all they know. No wonder kids despise veggies. There is nothing to inspire them to try when most things they eat are picked many months before, cold stored and ripened on the way to the supermarket.





In the Garage

I stumbled across aquaponics through a friend. I couldn't believe just how this whole thing worked. We had tried a normal veggie garden when we first moved into our home but it was hard work in poor clay soils. The garden never produced anything, and when our first baby came along we just didn't have the time. Aquaponics ticked all the boxes for us and we went from a very small herb garden with 12 goldfish via three different incarnations of our BYAP system to what we finally have now. 2 tanks holding 4000lt of water, 4 grow beds, 150 Rainbow Trout and 60 Murray Cod and an abundance of seasonally grown veggies.

We are using this as an educational tool for our two daughters as well. We see that teaching them about growing and harvesting your own food, is a life skill. Being a consumer of meat is also something we'll be able to teach them about. To have the luxury of nicely

presented meat in a butcher means that someone has had to kill the animal. We hope to teach them through the fish, that we need to respect the animal as well.

We've even named our system "**the patch**" and this is where this story will begin.

Over the coming issues we'll be



Abundant variety of aquaponic produce



Bean seeds emerge in just a few days

“ We see that teaching our daughters about growing and harvesting your own food, **is a life skill** ”

documenting our aquaponics journey. We'll talk about what we are sowing and harvesting, our trial and tribulations, experiments and failures.

From our four grow beds we aim to try and produce as much as possible from the system and reduce what we need to buy. We will rotate through each grow bed every few weeks to keep the supply of veggies flowing all year round. We'll plant seasonally so we are working with nature rather than fighting it.

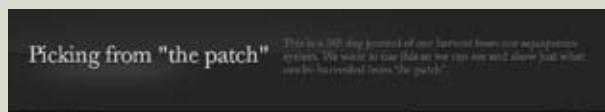
Currently we have an experiment going

within one growbed of our system. We picked the produce we wanted for the next season's crop and bought the seeds. My oldest daughter and I mixed all the seeds together and spread them all over the grow bed. We have no idea what is planted where. We really don't know how it will go. It may be a great way of plants sharing the space with each other avoiding pests and providing each other with support for growth and shade.

We had some amazing growth and it only took four days before we had little shoots of green appear. After 9 days we had plants everywhere and each day we see a little more growth. We'll keep you up to date with how well this experiment works in the next couple of editions.

So come along for the ride. It's going to be fun and we'll all learn something along the way. ●

Each magazine edition we will follow Mark and his family as they continue to experiment and eat from their aquaponics system. You can also follow their blog online at www.harvest365.blogspot.com



Day 87

Now that our get together yesterday is over we decided to get picking in the patch and take out some of the growing things we have been waiting to try. We left a few things in just as people would see the on the day.

So today was a big pick. A rockmelon, cabbage, chillies, radish, beetroot and carrots. Now you may notice the radish isn't red. That totally fine as not all radish are red.

Finally wanted to make some chutney and ginger jam but looking at the green chutney I knew when it was cooked it would get a brown colour. I thought red food colouring would do the trick but really wasn't happy with using artificial colours at all. That's when I hit on an idea. Rosemary jam! A green jam and that would add flavor and a strong red colour to my jam. The beetroot we picked today would be perfect.



And here is the result. It was late in the night so I couldn't get a great shot with the low light but its a gorgeous red colour and not looking fake and we used an organic veggie from the patch to help bring the colour and not something artificial.



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Grace eating the fat strawberry

About Us

Picking from "the patch"

Wynnum Vale, VIC, Australia

Just a Mum and Dad trying to do the best for our 2 daughters. Showing them how doesn't come from the supermarket while trying to make it as easy as possible.

[View my complete profile](#)

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“Okra is an **all-rounder**: nutritionally beneficial, useful for a wide range of cuisines and valuable medicinally”

Okra

By **By Faye Arcaro**

Okra is an annual plant in the hibiscus family which has many different common names that are used all over the world, including: Lady's fingers, gumbo, bhindi and quigombo; just to name a few. Despite its' aliases, the recognisable *Abelmoschus esculentus*, is a flowering plant that can reach nearly two metres tall



at full maturity. It is easily noticeable in the garden by its distinctive flowers, which have white and yellow petals, very often with red or fuchsia spots at the base.

The plant is primarily grown for its elongated seed pod, which is used as a vegetable. Having a sweet flavour and interesting texture, okra adds something

new and different to the table. The mucus-like liquid contained within it is commonly used as a thickening agent in stews.

HISTORY

Originally, okra was most likely cultivated by ancient Egyptians, almost three thousand years ago. Native to Ethiopia, the

plant made its way across most of North Africa and even into the Middle East. The seeds were enjoyed as a substitute for the more elusive (at the time) coffee. The seed pods were also consumed whole after being cooked thoroughly.

Slaves from West Africa were the source of okra in the New World (U.S.A.).

Quickly gaining popularity with the French colonialists, it became a major part of the local diet. The settlers were taught by the slaves how to use okra to thicken their soups. Even today it is grown in America by soup companies, and is still used as one of the key ingredients in thickening soups.

COOKING

Okra is a vegetable that has a wide range of uses in the kitchen. It adds more than





just its unique texture and flavour to a meal. In the Mediterranean and Middle East, the oil from the ripened seed pods is often used as a substitute for other edible cooking oils, since okra can thrive in conditions that many other crops can't.

On the surface, okra is already worthy of the garden patch because it does so much for a meal. Versatile veggies are hard to find and okra appeals to a wide range of preferences or tastes with its mild flavour. Okra can be cooked in a variety of different ways. You can:

- Boil it or microwave it until it is soft and tender. Squeeze some lemon juice over it and add a little freshly cracked pepper.
- Make an okra and tomato stew. Serve with rice, for a wholesome meal.

- Okra is a great addition to a curry, or can simply be sautéed with curry spices: cumin, coriander, turmeric and curry powder for example.
- As mentioned before, okra has thickening properties and therefore should be cut up in soups or stews that require longer cooking times, to really mix in its juices.
- Okras' flavour is very similar to eggplant, and can be used instead of eggplant in many recipes.
- Raw okra does well in salads, though some might find the mucilaginous aspect not to their liking.

HEALING PROPERTIES

For the health wary, okra is a blessing

- pod-size. The little green pod packs a veritable wealth of vitamins and nutrients. Thiamin, vitamin C, folic acid, riboflavin, calcium and zinc, are just a few that we can't do without, and are all contained within the potent pods. For the frequenters of late night bacchanalia, the gooey juice that exudes from okra has strong detoxifying properties, cleansing not only cholesterol but bile acid carrying harmful toxins filtered in the liver.

Okra is used as a diuretic by many and is occasionally used to treat urinary tract infections. The combination of its abundance of dietary fibre and binding properties with toxins makes it the ideal vegetable for anybody wishing to detoxify their body. Assisting with arteriosclerosis, supporting capillary structure and helping to contain and prevent asthma



Okra makes a welcome addition to soups, stews and curries



Pickled Okra – a great way to preserve bountiful harvests



In the Garden

are a few of the many benefits of okra.

It is believed that okras' high fibre content may assist diabetics as it is thought that it can stabilise the rate at which the intestines absorb sugars. Other research has shown that a diet containing okra may lower the risk of cataracts in the consumer.

GROWING OKRA

Conditions for growing okra are similar to those for growing tomatoes. Seeds should be planted out towards the end of spring in cooler regions, emulating the plants natural growing conditions in Northern Africa. Conditions that are too cool will offer very poor germination rates. The pH should be close to neutral; anywhere between



6.0 and 8.0 on the pH scale should be fine.

Germinating seed should be kept moist but not soggy and waterlogged, as this will again cause rotting.

The preferred range of temperatures for okra is 22 - 35°C. To achieve this, place the plant in full sun. Make sure that the plants are positioned such that the older plants will not shade the younger ones; okra can grow quite tall.

Okra grows extremely well in aquaponic systems, growth trials at the University of Virgin Islands (UVI) in their Deep Water Channel (DWC) system gave them yields of 2.67kg per square metre, while field grown trials gave them a harvest of only 0.15kg per square metre when growing the Clemson variety of Okra.

PROPAGATION

Okra can be propagated directly from seed or from young plants bought from a nursery. Soak the seeds overnight to help promote germination, although this isn't necessary when planting in most aquaponic systems. We have sown seeds directly to grow beds containing expanded clay media in a full sun position with excellent germination and growth results.

Seeds can be sown directly outside, or grown indoors in seed trays and transplanted six to eight weeks later.

When the seedlings reach a height of ten centimetres they should be thinned out. Spacing should allow about thirty centimetres apart to allow for development and to prevent overcrowding. If the plants are overcrowded the growth will appear stunted.

When transplanting okra, it can help to apply a seaweed spray to the leaves, this helps to lessen the shock of the transfer for the plant.

MAINTENANCE

There have been reports that okra rots surprisingly easily, in water logged soils however this doesn't appear to be an issue when grown in aquaponic systems with extremely high levels of moisture. When growing in soil okra can handle moderate dry spells, however during cold or wet seasons okra should not be watered.

Okra are highly sensitive to cold, so if you are growing in an area that is prone to cold snaps, you should probably only



attempt to grow after all risk of cold snaps has passed, or grow the plants in a controlled environment like a greenhouse.

Okra likes to branch out so pruning and further thinning out may be necessary. Cut back old and dead branches and foliage to encourage new growth and development, as well as to contain the plant.

PESTS AND DISEASES

Okra plants have relatively few pests to deal with. The most likely culprits are: silverleaf whitefly, looper caterpillars and green vegetable bugs. Chemical treatment is tricky to manage as insects can build resistances to them and the insecticides end up having limited effects. Inspection of crops is vital for early warnings.

Other pests to watch out for include aphids and mites, which can be dealt with effectively using appropriate sprays. We have found chilli garlic sprays to have a

positive effect on minor infestations.

If the plants' older leaves are yellowing and appear to be burnt, it most likely is afflicted with verticillium wilt. The only way to deal with this disease is complete removal of the diseased crop, to stop further spreading.

HARVESTING AND STORAGE

After 50 – 60 days, the okra should be ready to be harvested. Fallen flowers are a good sign and are a direct indicator that the okra is ready to be harvested. Okra pods can be picked daily, and should be soft. The trip-wire that pushes okra into the inedible zone is the time after the flowers have fallen – too long, and they can't be eaten; four days after the flowers have dropped is a good time to harvest.

The ideal size for picking is two to three inches in length. Some okra varieties have prickly hairs that can cause irritation to the skin. Ensure that gloves are worn

when harvesting these varieties. Pods should be cut off at the stem with a sharp knife, right above the cap of the pod.

Picking the okra daily will allow the plant to continue yielding. If not picked, the production of okra will slow down as the plant puts its energy into enlarging the existing pods and seeds. If they are picked, harvesting can continue right up until the first frosts appear.

Refrigerated pods can keep up to two weeks before spoiling.

Okra is an all-rounder: nutritionally beneficial, useful for a wide range of cuisines and valuable medicinally. With its general hardiness and only real demand being warmth and sunlight, it helps develop an extra dimension to the aquaponic system. Come springtime, sow the seeds after the last frost and give it plenty of sun – okra won't disappoint! ●

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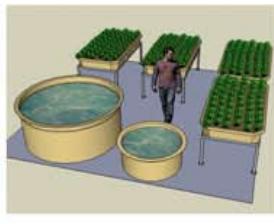
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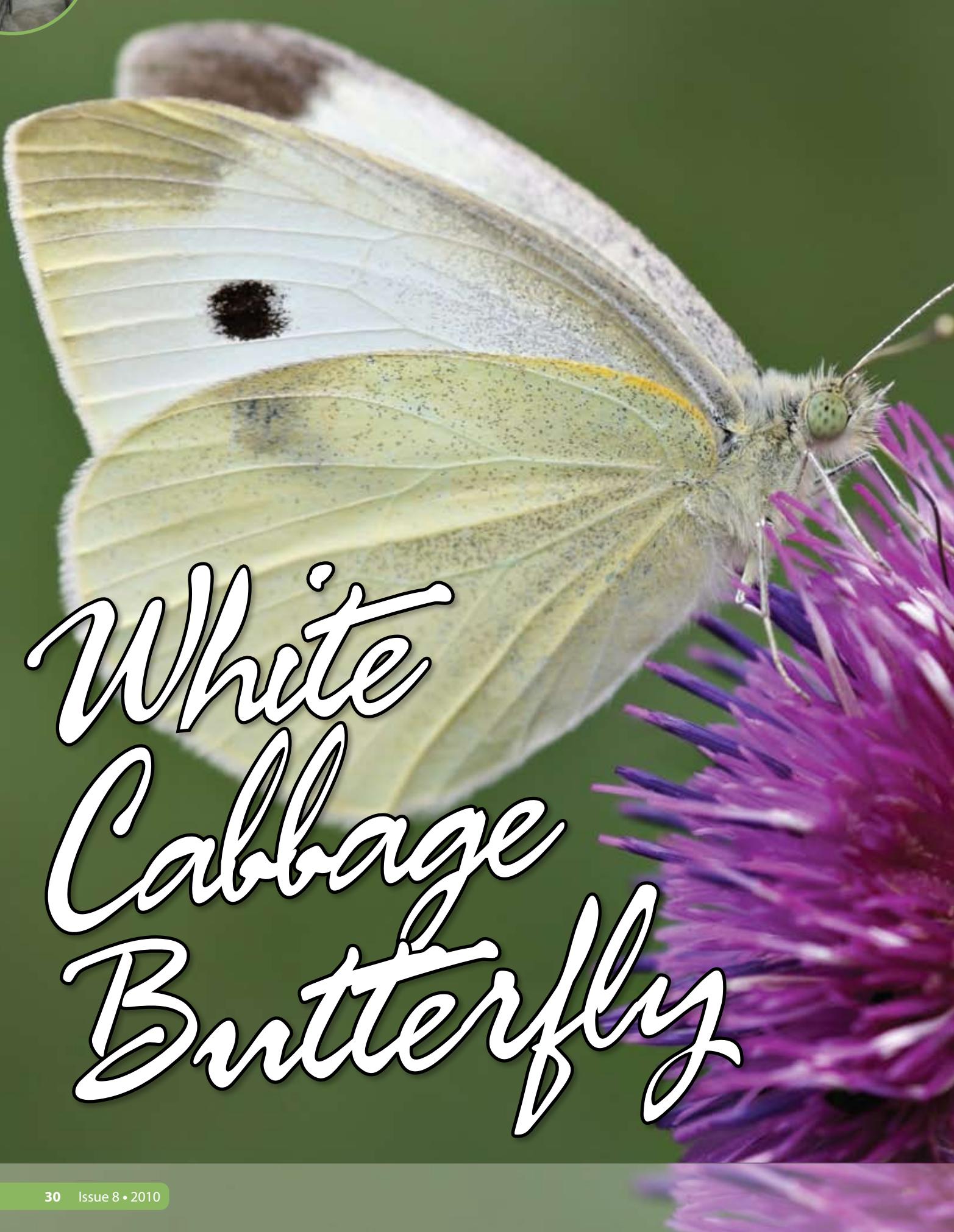
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On the Deck Chairs

White Cabbage Butterfly





One is often encouraged to believe that a garden full of healthy insect life is a good omen. Bees and butterflies pollinate plants and flowers, making them important for a garden's survival. It is often easy to be filled with pride upon the sight of fluttering butterflies and buzzing worker bees; signs of a thriving garden, a bustling eco-system full of life.

By **Faye Arcaro**

However, there is always a downside to every up. And for any aspiring vegetable grower, there are few creatures more annoying than the cabbage white butterfly. Sure, it may be a wondrous event to behold a horde of flapping white majesties drifting around your garden, but two weeks later the ugly truth will be

revealed. The eggs hatch and suddenly what was once a lovely spectacle is now turning into a chaotic situation as crops are slowly decimated.

Deceptively alluring, the species scientifically named *Pieris rapae*, has been the bane of many vegetable farmers globally. Originally populating Europe, North Africa and Asia, it was

accidentally introduced to North America, Australia and New Zealand, where the species proceeded to spread rapidly causing extensive damage to crops.

THE BUTTERFLY EFFECT

Owing to geographical boundaries, such as oceans or mountains, certain ecologies are never exposed to a wide variety of alien species. The white cabbage butterfly was mistakenly introduced into North America in the mid 1800's. It was first spotted in Canada in 1860, after which it proceeded to spread through the United States, reaching Hawaii in 1893.

New Zealand was the next country to be invaded, with first sightings being recorded in Napier in March, 1930. It later reached Australia's shores and was so favored by the environment that it spread across the whole country in less than four years. The damage was so overwhelming that natural



Pupa of the White White Cabbage Butterfly



On the Deck Chairs

enemies such as parasitic wasps were introduced.

KNOW YOUR ENEMY

Attacking cruciferous crops such as cabbages, swedes, turnips and other brassicas, the cabbage white butterfly is an insect to be wary of. The adult butterfly, however, is not directly the problem, but rather the larvae. With powerful mandibles for cutting through leaves, this caterpillar can be devastating to crops.

The white cabbage butterfly is often the first butterfly to appear at the beginning of summer. Often affectionately called the summer snowflake, the adults can be identified by their white wings with one or two dark spots.

The adults mate and the female lays her eggs on the inside of the crucifers or the



Newly emerged butterfly

undersides of the leaves. The eggs are laid singly, and are the shape of a bullet, of less than 1mm in length, with a distinctive yellow colour, making them difficult to spot.

The eggs then hatch into green larvae anywhere from five to fourteen days after they were laid. These little monsters are the vegetable gardeners' biggest problem. They devour the leaves, leaving gaping holes and more often than not they dig deeper to the heart of the plant, leaving a rotting shell of a vegetable in its place. When they burrow through the leaves they leave a green or brown deposit behind them.

The larvae then pupate and emerge as the second brood of butterflies, ready to start the whole cycle again.

PREVENTION IS BETTER THAN CURE

Thankfully, there are a variety of ways in which you can save your vegetables from

this pest. Depending on where you live and what your personal preferences are towards insecticides, there are plenty of non-invasive methods to choose from.

PARASITES

As the government in mid-19th century Australia realised, introducing parasites, such as native parasitic wasps, is a noninvasive method of killing off the white cabbage butterfly. The wasp *Apanteles* sp. parasitizes the cabbage white caterpillars, laying its eggs inside the caterpillars' body. The eggs hatch and the wasps' larvae devour the caterpillar from the inside out. While this method is more suited to the commercial growing of crucifers, it should be considered as it results in little to no damage to the ecology of your garden.

Other parasites to attract include: braconid and the tachonid fly. Both of these are attracted by plants such as dill and parsley, so think about introducing these and other herbs into your garden. Also, reduce the amount of insecticides used which may kill not only pests but also beneficial insects.

If you find dead, parasite-infested caterpillars don't throw them away! Take advantage of the situation and lay them in problem areas of your patch to help spread the parasites and eliminate the problem.

PREDATORS

The white cabbage butterfly may not look appealing to the seasoned gardener, but to



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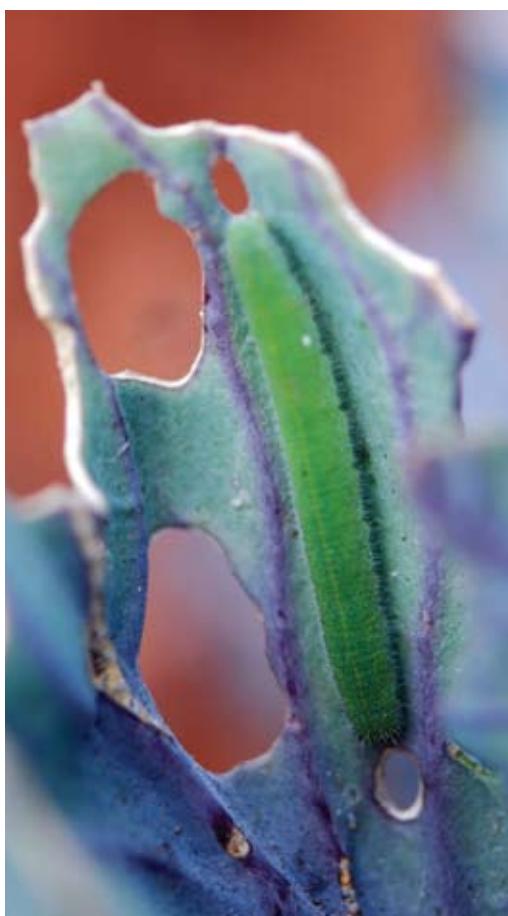


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various garden predators it looks absolutely delicious. One great way of preventing the development and spread of the pest is to introduce one or even better yet, more of its many natural predators.

Ladybird beetles are a good sign that natural biological control is occurring. Attract and maintain levels of ladybird beetles by planting flowering plants of different species to give the beetles a wide selection of food, otherwise they end up eating each other! Not only will this help increase your vegetable yield, but you will also be creating a beautiful garden to boot.

Other natural predators include lacewings and the weaver ant. Weaver ants require a lot of effort to attract to a garden, and if you're looking to go down this route speak to a horticultural expert at your local nursery. Lacewings can be attracted by dill, sunflowers and carrots – flowering plants are a good choice.

Moving to predators on a larger scale, it is recommended that you encourage small,

insect-eating birds to populate your garden. You can do this by using bird feeders and having a constant supply of water set up. Constructing places for them to nest will also encourage birds to stay.

PHYSICAL PROTECTION

Use special plant covering, stockings or just mosquito netting, to swathe your plants and prevent the adults from laying their eggs.

If you feel like doing something a little more hands on, walk around and inspect the underside of the leaves, of all your brassicas. Pick off the caterpillars and give the fish a tasty treat or look out for the signature yellow eggs and be sure to crush them by rubbing them between your fingers. The adult females generally lay them around the sharper edges where there is more grip, so this should be the first place to check.

The best time to do this is after you see large numbers of cabbage whites hovering around your plants, as their eggs have almost certainly been produced.

A butterfly net is another useful tool and can be used to catch the adults, although this requires a little more practice and effort than squashing the butterflies eggs before they hatch; a much loved activity for young children.

One purported deterrent is the use of white stones and eggshells, placed near and around the crucifers. These totems are supposed to resemble the white wings of the butterfly, and are meant to trick the adults into thinking that the plant is already overpopulated. This can also be achieved by tying strips of white fabric to canes or trellises above or near crops, resembling butterflies with wings that flap in the breeze.

TREATMENTS

Unfortunately, if the larvae have hatched and established it is hard to save your crop, especially if they have eaten through the

heart. However there are a few methods for killing off any surviving caterpillars.

One effective way of treating the caterpillars is by introducing a naturally occurring bacteria *Bacillus thuringiensis*, which kills the caterpillars and leaves the predatory insects unharmed. The caterpillar eats the treated leaf, gets an upset stomach stops eating and will die within four days, the bacteria should be re-applied weekly for the duration of the infestation. It should be applied in the late afternoon, and should not be sprayed when wet weather is imminent, as it will wash away and become ineffective. In Australia this product has gained organic certification, is safe for use in conjunction with fish, bees, ladybirds, mammals and pets, and is commonly sold by Yates under the name Dipel.

This is a great alternative to chemical insecticides, which not only require vegetables to be thoroughly washed before eating, but also kill beneficial insect life. Other substitutes to commercial chemical sprays include using garlic and chilli spray or diluted worm leachate, which can also act as a repellent.

Always be sure to carefully follow the manufacturers' instructions when mixing products. Note the safety warnings and wear appropriate protective equipment.

IDENTIFICATION

Just because your cruciferous crops are suffering does not necessarily mean that the white cabbage butterfly is to blame. If you notice slime trails encircling the plants, then your culprit is the slug or snail. This may seem a small detail, but if details are overlooked, plenty of time and money can be invested to solve a problem that does not even exist.

Keep your eyes open and your mind aware and your garden will be fine. Next time you see a fluttering of white across your crops, admire it for a minute, take a picture and grab your butterfly net. ●



A Beginning and an End

— Interview with Dr James Rakocy

This is the first of a series of interviews with people who are influential in shaping the burgeoning American aquaponics scene. While the U.S. is several years behind (5 years?) Australia in integrating aquaponics into the gardening culture and lexicon, there is more and more publicity in the US about aquaponics that should advance the public's understanding. For example, the February 18, 2010 New York Times featured aquaponics on the front page of the Home section in a story titled "The Spotless Garden". (<http://www.nytimes.com/2010/02/18/garden/18aqua.html?em>)

By **Sylvia Bernstein**

I

It seems fitting to start this series with an interview with Dr. James Rakocy of the University of the Virgin Islands. Dr. Rakocy has arguably been the most influential person in developing US aquaponics, and perhaps the single most influential person in worldwide aquaponics as well. Dr. Rakocy is retiring in November of this year after devoting 30 years to researching, developing and promoting aquaponics. What follows is an interview with him conducted on February 19, 2010

Q - How does it feel to be called the father of U.S. aquaponics?

Dr. Rakocy - Humbling. There actually were a few others before me. There were articles on aquaponics in the Transactions of the American Fisheries Society in the late 1970s



by William Lewis and his students at Southern Illinois University in Carbondale. The idea of using plants to treat water and remove nutrients had been around for a while. I first learned of the concept from Leonard Pampel, who used plants to treat wastewater in the aviary building at the Milwaukee County Zoo. Mr. Pampel obtained a patent on that system, I helped him design integrated aquarium systems when I was a junior high school student and he later provided input to my doctoral research at Auburn University.

Q - What was the focus of your doctoral research?

Dr. Rakocy - In RAS (Recirculating Aquaculture Systems) you needed to exchange 5-10% of the water every day with new water due to buildup of nitrate ions. I

had a hypothesis that you could use aquatic plants and vegetables to remove nitrates and therefore use much less water. Aquaponic systems typically exchange less than 1% of the system's water daily. I wanted to solve the problem of nitrate buildup and higher water exchange rates in RAS by using plants to remove nitrates.

Q - What were people's reactions to your doctoral thesis?

Dr. Rakocy - When I came out of Auburn University I got the feeling that people thought I was on the lunatic fringe. They don't anymore. Upon graduating I had opportunities at UVI and at the Kuwait Research Institute. I'm glad that I didn't go to Kuwait. When

Iraq invaded Kuwait scientists working at the Kuwait Research Institute applied for jobs at UVI.

Q - Why did you get into this?

Dr. Rakocy -

The biggest motive was an interest in RAS stemming from having aquariums in my basement. Yes, as a boy I was a fanatic about raising ornamental fish. I had 17 aquariums in my basement. In the Peace Corps in the West African country of Sierra Leone I saw malnutrition and became interested in working to solve the problem of world hunger. In working toward a master's degree in the Department of Environmental Sciences and Engineering at the University of North Carolina I was exposed to wastewater treatment techniques. Aquaponics combined all these interests.

Q - How did the program at UVI come about?

Dr. Rakocy - I became the Director of the Agricultural Experiment Station 23 years ago and have been part of the program at UVI for 30 years. At first it was called "integrated systems" before one of the short course students coined the term "aquaponics" - definitely better than integrated systems, which could refer to anything! We started raising tilapia and aquatic plants, water chestnuts, and water cress for PhD research. I was surprised when we started research at UVI



Dr. James Rakocy

that terrestrial food plants grew so well. I was even more surprised that fish waste provided a good balance of nutrients for hydroponic vegetables. We have found that it really comes down to how much fish feed per square meter of plant you are growing in an area per day (example – 60g /m²/ day for lettuce)

Q – Tell us what the beginning of the program was like.

Dr. Rakocy – Well, there was no research facility. We had some inexpensive vinyl lined steel walled swimming pools and were told to make the aquaculture research facility a showpiece. The first aquaponic system consisted of 3 ½ metal oil barrels. One was used to raise fish. One was cut in half to create two hydroponic beds. One was used as clarifier with a cone welded into the bottom. And half of the final barrel was used as a sump. We had the first barrel aquaponic system 30 years ago. However, the goal of an Agricultural Experiment Station was to produce large food production systems. So we went to 3000 gallon rearing tanks with two hydroponic tanks that were 20' long by 4' wide and 16" deep. We needed 6 of these systems so we could have 2 treatments replicated 3 times for scientific integrity. We worked with media (gravel) based systems first, but found that gravel was difficult to work with and not feasible for large commercial operation. We decided early on that a raft system with solids removed was the way to go for commercial production. Finally we went to the current commercial-sized system of 4 fish rearing tanks with staggered production so that one tank can be harvested every 6 weeks. We used six hydroponic tanks that are 100 ft. long by 4 ft. wide by 16 inches deep. It's not high-tech, but is designed for what a typical farmer can handle. We have been running this commercial system continuously for 8 years.

Q – When did you start offering the Aquaponics Short Course?

Dr. Rakocy – We decided 11 years ago it was time to emphasize training and promotion so we started the short course (Aquaponics and Tilapia Aquaculture). The first year we had 17 students, and then attendance grew to 33 students, barely fitting the room size available. In the last three years, a new conference center provided a room with capacity for 74 students. In 2007 we had 63 students representing all 7 continents (we actually had someone from the North Pole Amundsen-Scott Research Station). I have had students from 42 US states and territories and 47 other countries including several countries from South America, Africa, Asia, Europe and the Middle East. In 2008 we had 73 students and changed the course name to International Aquaponics and Tilapia Aquaculture Course.

We have taught 418 students so far. Sadly, this will be my last year teaching this course unless I am hired by the university to come back and teach.

Q – Why do you think you have had such a successful program at UVI?

Dr. Rakocy – Because UVI is a land grant university and has formula funds from the federal government, we didn't have to compete for short term competitive grants, although several competitive grants were obtained over the years. Formula funds are a stable source of funding. There have been MS and PhD projects at universities over the years due to individuals' interests, but when a student finished and moved on, no more research on aquaponics was conducted at that university. UVI has been the only institution to pursue aquaponic research for an extended time period. Typically land grant universities must meet stakeholder needs and states have many commodity groups competing for research attention to their problems. The Virgin Islands has a small agriculture industry and therefore has less stakeholder demand for research. The Aquaculture Program was started to develop systems appropriate for the dry conditions of the Virgin Islands and therefore I was very lucky to have the luxury to pursue developing aquaponic and biofloc technology for 30 years. There were no demands from stakeholder groups.

Q – What are the biggest opportunities you see in the future of aquaponics?

Dr. Rakocy – I never anticipated the growth of hobby / backyard systems, which now could number close to 1500 in the US. Also the dramatic increase in the adoption of aquaponics in schools (estimates are about 1000 schools in the U.S. currently using aquaponics as a science teaching tool). I get constant email inquiries and am now receiving many more inquiries from college students doing class projects. Finally, aquaponics is at a stage of increased and critical mass of interest, knowledge and financing and all three are coming together for commercial development. We will start seeing bigger commercial installations.

Q – What are the biggest issues?

Dr. Rakocy – People jumping on the bandwagon and pawning themselves off



as educators and consultants who don't really know what they are doing. This will lead to failures and tarnish the image of aquaponics. The same phenomenon occurred years ago with aquaculture in general.

Q – What are the pros and cons of living in the Virgin Islands?

Dr. Rakocy – Cons – Well, there isn't much nightlife in St. Croix. In fact, there has been a noticeable decline over 30 years (note – Dr. Rakocy is an active bachelor). The islands in general are very confined. Plus, there is the hurricane threat. I've experienced five hurricanes, and been in the eye of three very strong hurricanes. Pros – I've had a good career there with lots of flexibility. I've become a director, a professor and consultant, and have had great opportunities for travel. And The Virgin Islands have beautiful vistas, pastoral landscape, a relaxed atmosphere (no traffic jams) and are good for water sports and beach activities.

Q – What are your future plans?

Dr. Rakocy – I'm retiring at the end of November and am looking forward to living in Thailand in a condo on Golden Buddha Hill overlooking the Gulf of Thailand. I love to ski, especially in Lake Tahoe and am planning to set aside one month a year for skiing. But I will also work part time for Nelson and Pade Inc on commercial aquaponic projects.

Thank you for your priceless contributions to aquaponics over the past 30 years, Dr. Rakocy. You will be sorely missed when you retire. ●

Next issue – Rick Mueller, Aquaponics Manager at Growing Power in Milwaukee, Wisconsin



This edition of the magazine sees us take things forward another step with a printed version becoming available. The magazine will be available either as an electronic subscription, or in a printed format. For current subscribers who wish to receive printed editions, we will be sending out details of how to upgrade soon.

Work is well under way on the **ninth edition** of the magazine.

We will continue to showcase systems belonging to members of the online discussion forum, there will be information on vegetables and plants well suited to aquaponics systems, plus lots of useful hints and tips.

It's promising to be an exciting issue, packed full of information.

**Issue 9
OUT
SOON**

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